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COLD WATER CLEANING AND SANITIZING OF KITCHENWARE IN THE FIELD

BY

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UNITED STATES ARMY NATICK
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SOLDIER SCIENCE DIRECTORATE

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			CLEANING	COLD WATER	

19. ABSTRACT (Continue on reverse if necessary and identify by block number)

In emergency situations in the field, where reduction in the use of heat generating equipment is called for, there is a need for a procedure to clean and sanitize kitchenware in cold (ambient) water. It was found that dirty pots, pans and kitchen utensils could be successfully cleaned and degreased by hand scrubbing in a sink containing a 5% solution of a commercial cleaner/degreaser at 15°C (59°F). The scrubbed article was then rinsed in a sink filled with water held at the same temperature, and was sanitized in a third sink containing a solution of a commercial quaternary ammonium sanitizing agent at 15°C. Results from swab tests performed on processed articles showed the total bacterial count to be either absent or well below the permissible level. The procedure was judged to be highly successful in cleaning/degreasing and sanitizing kitchenware in cold water. Additionally, in a field test situation, individual mess gear was successfully cleaned and sanitized at an ambient temperature of 20°C (68°F).

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PREFACE

This report covers studies conducted from October 1988 to September 1989 on development of a procedure to clean/degrease and sanitize dirty kitchenware in the field in the absence of abundant hot water. This study was initiated by the Air Force and was supported under Program 63747, Project No. D610 and Task 26.

The use of trade or manufacturers' names in this report does not constitute an official endorsement or approval of the use of any commercial product. This report may not be cited for purposes of advertisement.

We thank Mr. Martin Tiner and his kitchen staff at the U.S. Army Natick RD&E Center company mess hall facility, and Col. Gary DuMoulin, 399th Combat Support Hospital, U.S. Army Reserve Unit, Taunton, MA, and his staff, for their cooperation in conducting demonstration studies and field tests.

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Cold Water Cleaning and Sanitizing of Kitchenware in the Field

Introduction

The objective of this study was to develop a method for cleaning and sanitizing kitchenware in the field using reduced amounts of unheated water at ambient temperature. The efficacies of over 100 different combinations of various commercial cleaning/degreasing agents in various concentrations had been surveyed by previous investigators[1]. Their results, obtained from field testing the selected prototype, Mikroklene (Ecolabs, St. Paul), showed that the product (an iodophore) was not able to cut through the grease even with use of a scouring pad. Because of the failure of the prototype to cut grease at lower ambient temperatures (15°C to 20°C) the requirement for cold water had been amended[2] to find the minimum temperature at which the prototype or any other cleaner/degreaser could cut the grease.

After undertaking the project, the present authors adopted the position that a surface should be completely free from grease if a sanitizer is to function effectively and, further, that if the surface was clean then any one of a number of sanitizers would probably function equally well. Therefore we opted to separate the two functions into (1) grease cutting ability and (2) sanitizing ability. We reviewed the grease cutting abilities of the products previously surveyed, together with several which had not been examined previously. Our approach was to select those products with good grease cutting ability and then determine the lowest temperature at which they were effective.

Materials and Methods

Laboratory Scale Evaluation Methods

Beef suet was purchased from local markets and rendered in a frying pan. The grease was collected and stored in a refrigerator until used. Samples of grease were weighed and spread on stainless steel or plastic coupons (2 in X 2 in) or were spread over the inside surfaces of a variety of different aluminum pots. Degreasing capability was surveyed by the following procedure: a coupon was suspended in a beaker containing the desired concentration of cleaning/degreasing agent. The beaker was equipped with a magnetic stirring bar (Fig. 1) and was placed in a temperature-controlled water bath. The extent of degreasing was judged (subjectively) after various durations of stirring agitation at temperatures ranging from 25°C (77°F) to 45°C (113°F). The efficacy of a number of different products could thus be estimated in a relatively short period of time. A second efficacy evaluation method was to mount several coupons on a larger plate, which could be placed in an automatic dishwasher (Hobart), either with or without other grease-laden kitchenware, for a comparative study of various cleaning/degreasing products.

Efficacy was also evaluated by filling a large plastic beaker with three to four liters of cleaner/degreaser at concentrations suggested by the manufacturer (1:3, 1:10, and 1:20 dilutions, depending upon the degree of soiling). These efficacy tests were carried out at several different temperatures, ranging from 15°C to 45°C. An article of kitchenware, which had been spread with a layer of a weighed amount of beef fat, was placed in the beaker and manually scrubbed with a nylon scouring pad. After rinsing the article in water at the same temperature, researchers made an evaluation as to

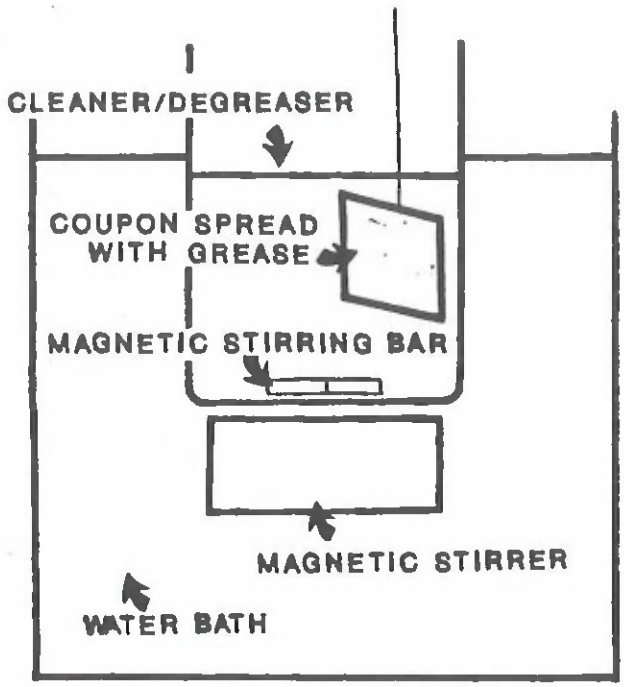

Fig. 1. Apparatus used to survey cleaning/degreasing agents

the efficacy of grease removal. The semiquantitative evaluation took into account the number of items that could be successfully degreased before the accumulated grease and scum prevented the cleaning/degreasing of additional items.

Table 1 lists the commercial products tested for their ability to clean/degrease grease-laden test articles. Several of these (Encompass, Instru-Klenz, and Vesta-Power) proved to be superior in degreasing ability and were examined in more detail.

Swab Test Procedure

Sanitation was evaluated with the Millipore Total Count (TC) Swab Test Kit (Millipore Corp., Bedford, MA). Five randomly selected 8 in^2 surface areas on the item were swabbed with a single swab, in the shape of an "M", for a total of 40 in^2. The swab was then inserted into the chamber containing 18 mL of of sterile phosphate buffer and shaken to dislodge the microorganisms. The swab was removed and discarded. The TC sampler (nutrient medium-membrane) was placed into the buffer chamber for 30 seconds, during which time it absorbed 1 mL of liquid. The sampler assembly was shaken to remove excess buffer, placed in an empty sterile chamber and incubated at 30°C for 48 to 72 hours. Visible colonies were counted. In order to pass the sanitation criteria the maximum total count cannot exceed 500 per 40 sq.in^3.

Operational Tests

I. Natick Mess Hall: Kitchenware was washed using the three sink method[4]. Prior to the cleaning procedure excess grease and other loose

TABLE 1. Various cleaning agent products tested for cleaning and sanitizing ability

409 Cleaner, The Chlorox Co., Oakland, CA
Aerosol, Horne and French, Inc., Boston, MA
Ajax, Colgate-Palmolive, New York, NY
Alcalase 2.0T, Novo Laboratories, Inc., Wilton, CT
Alcalase 2.5LA, Novo Laboratories, Inc., Wilton, CT
Alcide LD, Alclde Corp., Westport, CT
Alcojet, Alconox Inc., New York, NY
Alcotab, Alconox, Inc., New York, NY
Amazon, Trio Chemical Works, Brooklyn, NY
Aquiline A, Vernitron Medical Products, Carlstadt, NJ
Bactophene, Oxford Chemicals, Atlanta, GA
Buell LQ, Polychem Corp., New Haven, CT
Cheer (powder), Proctor and Gamble, Cincinnatl, OH
Chlortergent, Oakite Products, Inc., Berkely Hts, NJ
Cyclo 84-0902, Cyclo Chemicals Corp., Miami, FL
Cyclo Cycloryl LDC, Cyclo Chemicals Corp., Miami, FL
Dawn, Proctor and Gamble, Cincinnati, OH
Dermicide 2000, Minnitonka, Inc., Minneapolis, MN
Dishmaglc, Consolidated Chemicals, Inc., St. Louis, MO
Dy-Gest 1, Ecolab, St. Paul, MN
Encompass, Ecolab, St. Paul, MN
Fantastic, Texize, Greenville, SC
Filmtec alkaline cleaner, Filmtec Corp., Minneapolls, MN
Formula 202 Stainless Steel Cleaner, Schinly Corp., Waltham, MA
General Purpose Detergent, Lighthouse for the Blind, Houston, TX
Grime Fighter, California Chemical Co., National City, CA
Heavy Duty Chlorinated Detergent, W. C. Bonner Co., Watertown, MA
Heikolax-A, Heinecke Instrument Co., Hollywood, FL
Instru-Klenz, Calgon-Vestal Laboraories, St. Louis, MO
Joy, Proctor and Gamble, Cincinnati, OH
Kodak lens cleaner, Eastman Kodak Co., Rochester, NY
Lipase, American Laboratories, Inc., Omaha, NE
Lo-Temp 21, Luseaux Laboratories, Gardena, CA
Micro, International Products, Inc., Trenton, NJ
Mikroklene, Economics Laboratory, Inc., St. Paul, MN
Monofax 1214, Mono Industries, Paterson, NJ
Pot and Pan Detergent, Grace-Lee Products, Minneapolis, MN
Prepodyne Scrub, West Chemical Products, New York, NY
Quikomatic, Colgate-Palmolive, New York, NY
Roccal, National Laboratories, Montvale, NJ
Scrub, West Chemical Products, New York, NY
Sterilution, W. C. Bonner Co., Watertown, MA
Super Klor, Dubois Chemicals, Cincinnati, OH
Super Lusteraid, W. C. Bonner Co., Watertown, MA
Tergitol 7, Carbide and Carbon Chemicals, New York, NY
Termonyl 300 L,A, Novo Laboratories, Inc., Wilton, CT
Termonyl 60T, Novo Laboratories, Inc., Wilton, CT
Tide, Proctor and Gamble, Cincinnati, OH
Triton DF-12, Rohm and Haas, Philadelphia, PA
Tween 80, Atlas Powder Co., Wilmington, DE
Type II, Carroll Co., Garland, TX
Type II detergent, Carroll Co., Garland, TX
Vesta Power, Calgon-Vestal Laboratories, St. Louis, MO
Windex, The Drackett Products Co., Cincinnati, OH

See Preface for tradename disclaimer.

material was removed by wiping each soiled article with a paper towel. The water temperature was tested at 15, 20, 25 and 30°C. The pots, pans, and kitchen utensils from two breakfasts and three lunches (each feeding 40-50 persons) were cleaned and sanitized, starting at 30°C (86°F) at a 10% concentration of the liquid cleanser/degreaser, and working successively to 25°C (77°F) at 10%, then 20°C (68°F) at 10%, then 20°C at 5% concentration, and finally, 15°C (59°F) at 5% concentration. The sanitizer was used at the recommended concentration. After sanitation, selected articles from each meal were analyzed for total bacterial count[3] with the Total Count Swab Test Kit.

II. Field Study: The study was conducted by the 399th Combat Support Hospital US Army Reserve Unit (Taunton, MA) during field exercises in August 1989, at Fort Drum, NY. Three 30-gallon garbage cans were prepared for use as cleaning agent, rinse, and sanitizer containers. Can #1 was filled with 23.75 gallons of ambient water (20°C). The cleaning/degreasing agent was added (1.25 gallons) to yield a 5% concentration. Can #2 contained 25 gallons of 20°C water and was used as a rinse. Can #3, filled with 25 gallons of 20°C water, received 185 mL of a liquid sanitizer to yield the recommended concentration of sanitizer (1 oz/4 gallons).

Approximately 10% of the meal participants were randomly selected to have their mess kits cleaned by the ambient water method. These randomly selected individuals passed their mess kits to the first of three assigned personnel, all of whom wore heavy butyl rubber gloves in the sequence below.

Can 1. The mess gear was scrubbed with a brush and/or scouring pad to dislodge food particles and to clean/degrease the article.

Can 2. The article was rinsed in rinse water.

Can 3. The article was rinsed in sanitizing solution, removed, and allowed to drain.

After draining for several minutes the mess gear was swabbed for total count with the Millipore Total Count Swab Test Kit. To alleviate any apprehension about the efficacy of the test among the personnel, all articles of mess gear, after swabbing, were put through the standard cleaning and sanitizing operation at >180°F (>82°C) to boiling.

Results

Laboratory scale survey experiments performed with the system described in Fig. 1 showed that grease-laden articles could be successfully degreased at temperatures as low as 15°C (59°F). The most promising of the products screened included Vesta-Power, Instru-Klenz and Encompass. Subsequent comparative studies using a variety of different concentrations and temperatures clearly demonstrated the superior efficacy of Vesta-Power, especially at lower temperatures. However, in the apparatus described in Fig. 1, complete degreasing at 15°C was achieved only at the relatively high concentration of 1:3 dilution of Vesta-Power, a concentration that was considered to be too high to be of practical economic value for use in the field. Further studies showed that although the apparatus described in Fig. 1

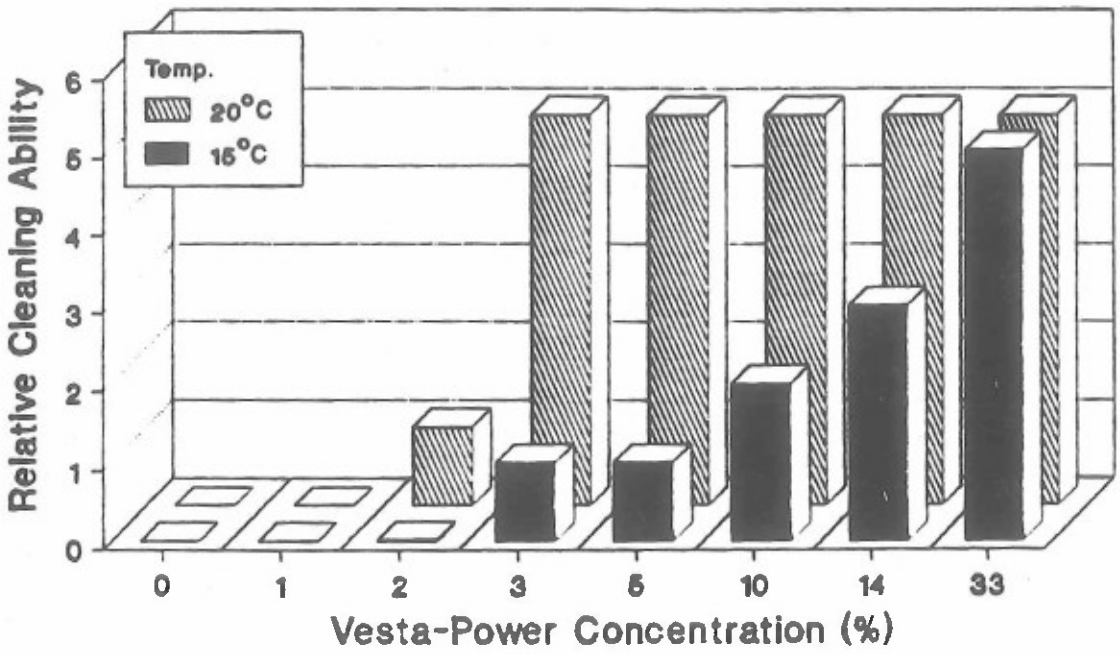

Fig. 2. Efficacy of Vesta-Power at 15°C and 20°C as a Function of Concentration

could be used as an indicator of relative efficacies in screening products, the accurate estimation of efficacy as a function of concentration and temperature could be achieved only in a field test situation.

Fig. 2 shows the efficacy of Vesta-Power (as judged by the number of pots degreased) in removing beef fat, spread in a thin layer on the surface of an aluminum pot, as a function of concentration and temperature. It is apparent that degreasing ability is strongly affected by small changes in temperature.

In a demonstration test in the Natick Mess Hall, the pots, pans, and kitchen utensils from two breakfasts and three lunches were successfully cleaned, degreased (Vesta-Power) and sanitized (Syn-Cide Plus, Calgon-Vestal Laboratories) at all of the concentrations and temperatures tested as described above (Table 2). Judging from the lack of appreciable buildup of scum, even at the lower temperature of 15^{o}C, there appeared to be sufficient capacity remaining to allow for the cleaning of three to four times as many pots and pans before being necessary to change the wash water. Total counts obtained from the swab test kits were within the acceptable limits (Table 2).

The results obtained from the field testing of the efficacy of Vesta-Power and Syn-Cide Plus in cleaning, degreasing and sanitizing mess gear are shown in Table 3. Swab test results indicated that, overall, 98% of the mess gear was acceptably sanitized by the described procedure.

TABLE 2. Swab tests of kitchenware cleaned and sanitized in Natick Company Mess Hall

Meal Served	Temp. °C	Concentration of cleaner/degreaser (%)	Swab Test Kit Colony count per surface area[a]
Lunch	30	10	0
Breakfast	25	10	8
Lunch	20	10	0
Breakfast	20	5	4
Lunch	15	5	2

[a]Colonies per 40 sq. in. Recommended maximum number of colonies per 40 sq. in. area = 500[3]. Number of colonies on sampler equals 1/18 of total (see Materials and Methods). To pass sanitation test the count cannot exceed 500/18 = 27 colonies per sampler.

TABLE 3. Swab tests of mess gear cleaned and sanitized in field test study

Meal Served	Number of swab tests exceeding limit[a]
Supper	1/15
Breakfast	0/15
Supper	0/25
Supper	1/50
Breakfast	1/40

[a]The sanitation test fails if the colony count exceeds 27 colonies per sampler[3].

Discussion and Recommendations

From the mess hall exercise, it is estimated that one sinkload of 5% cleaner/degreaser (1.75 gallons of Vesta-Power per 35 gallons) could successfully clean the pots, pans and kitchen utensils used to prepare a meal for the feeding of 160 to 200 personnel using water at a temperature as low as 15°C (59°F), provided that the excess food and grease is scraped, wiped and removed prior to washing.

In an emergency situation in the field, in the absence of heated water and/or where water is in limited supply, the use of 5% Vesta-Power followed by a rinse and by exposure to a quaternary ammonium compound sanitizer will successfully clean and sanitize mess gear, at a temperature at least as low as 20°C (68°F). This capability was demonstrated in the field test, and perhaps the cleaning/sanitizing capability could even be extended in the field to a temperature as low as 15°C, as was shown in the Mess Hall demonstration test. With the kitchen cleanup water allowance limit in the field of 2.35 gallons of water per day per soldier, or 0.78 gal per day per soldier in an arid environment[5], there would be a minimum of 84% savings in water in a temperate environment and a 52% savings in an arid environment.

In the Field Test results the acceptable colony counts ranged between zero and 25, with three counts exceeding the acceptability level (one each from three of the five meals), being rated at >300. Since the difference between these high counts and the acceptable low counts is an order of magnitude, these high counts might be attributable to the lack of aseptic conditions existing in a field environment, and/or to the inexperience of the personnel performing the swab test procedures. We recommend more extensive field testing of the

described procedure in order to determine better the efficiency of sanitation achieved.

Manprint safety considerations would require those personnel assigned to wash (degrease) kitchenware to wear long, heavy butyl rubber gloves and eye protection[6]. Although the consultative letter referred to (ref. 6) was directed toward the use of an iodophore in a field study, the Material Data Safety Sheets (Appendix) on Vesta-Power and Syn-Cide Plus state that both gloves and goggles should be worn. We believe the requirement for rubber gloves should stand. However, we feel that wearing goggles should be a requirement only for the individual(s) making the initial dilution where splashing of a concentrated solution may occur.

This document reports research undertaken at the US Army Natick Research, Development and Engineering Center and has been assigned No. NATICK/TR-90/013 in the series of reports approved for publication.

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2. Memorandum for the Record, Subject: With Air Force Liaison Officer on MSR1490, 2 Aug 1988.

3. Standard Methods for the examination of dairy products: microbiological and chemical. Eleventh edition. USPHS Publication 1631 (1967).

4. NAV MED P-5010, Bureau of Med. and Surgery, Dept. of Navy, Washington DC, 1978.

5. Department of the Air Force, The Prime Ribs Manager's Handbook, Air Force Pamphlet 140-4, Sept. 1983.

6. Consultative letter, 87-065E0196ETB, USAF Occupational and Environmental Health Laboratory (AFSC), Brook Air Force Base, TX, 18 May 1987.

APPENDIX

Material Data Safety Sheet - Vesta Power

Material Data Safety Sheet - Syn-Cide Plus

MATERIAL SAFETY DATA SHEET

CALGON VESTAL LABORATORIES

I - PRODUCT IDENTIFICATION

COMPANY NAME: Calgon Vestal Laboratories

ADDRESS: 5035 Manchester Avenue
St. Louis, Missouri 63110

Tel No: (314)535-1810
Nights: (314)862-2000
CHEMTREC:(800)424-9390

PRODUCT NAME: Vesta Power

Product No.: B258

Synonyms: Aqueous Liquid Detergent/Degreaser

II - HAZARDOUS INGREDIENTS OF MIXTURES

MATERIAL: (CAS#)	% By Wt.	TLV	PEL
Sodium Metasilicate (6834-92-0)	<5%	N/A	N/A

III- PHYSICAL DATA

Vapor Pressure, mm Hg: N/A	Vapor Density (Air=1)60-90F: N/A
Evaporation Rate(ether=1): N/A	% Volatile by wt @105C/1 hrs. 90-91
Solubility in H2O: Complete	pH @ 1+3 Solution 12.4
Freezing Point F: Circa 32F	pH as Distributed: 13
Boiling Point F: @14.7 psig @212	Appearance: Clear,purple liquid
Specific Gravity H2O=1 @25C: 1.05	Odor: Near odorless

IV - FIRE AND EXPLOSION

Flash Point F: None to boil	Flammable Limits: N/A

Extinguishing Media: Suitable for surrounding area - water, dry chemical, foam, CO2.

Special Fire Fighting Procedures: N/A

Unusual Fire and Explosion Hazards: N/A

V - REACTIVITY DATA

Stability - Conditions to avoid: None

Incompatibility: None known

Hazardous Decomposition Products: Forced ignition of dried residues may produce CO, CO2, nitrogen oxides.

Conditions Contributing to Hazardous Polymerization: Will not occur.

(Cont'd on Page 2)

VI - HEALTH HAZARD DATA

EFFECTS OF OVEREXPOSURE (Medical Conditions Aggravated/Target Organ Effects,
A. ACUTE (Primary Route of Exposure) EYES: Detergent in the product is irritating to the eyes. SKIN: Product is not a primary skin irritant by FHSA.Prolonged and repeated contact may cause irritation as indicated by pH in product. INHALATION: Mists or spray can irritate nasal passages. INGESTION: Acute oral LD50 (rats) >5000 mg/kg.Ingestion of large quantities causes upset to the stomach.
B.SUBCHRONIC,CHRONIC,OTHER: No available information was found.

VII - EMERGENCY AND FIRST AID PROCEDURES

EYES: Flush eyes with flowing water for 15 minutes,call a physician.
SKIN: Rinse affected area thoroughly with flowing water.
INHALATION: Remove source of irritation. INGESTION: Give large quantities of water or milk followed by vinegar or lemon juice and immediately contact a physician.

VIII - SPILL OR LEAK PROCEDURES

Spill Management: Small spills may be mopped up and residues flushed to the sewer with water.Rinse mop before storing.May be neutralized with dilute acetic acid.

Waste Disposal Methods: Dispose spent solutions in accordance with local,regulations.

IX - PROTECTION INFORMATION/CONTROL MEASURES

Respiratory: Avoid breathing mists or spray.	Eye: Goggles or face shield	Glove: For manual cleaning

Other Clothing and Equipment: Not normally required.

Ventilation: Normal room ventilation.

X - SPECIAL PRECAUTIONS

Precautions to be taken in Handling and Storing: This product will withstand an occasional accidental freezing without loss in its normal performance characteristics.It must be thoroughly thawed and agitated (roll drum) before being used.Store in heated area below 135F.
Additional Information: Read and observe labeled use instructions.

Prepared by:R.C.Jente Revision Date:10/06/87

Seller makes no warranty, expressed or implied, concerning the use of this product other than indicated on the label. Buyer assumes all risk of use and/or handling of this material when such use and/or handling is contrary to label instructions.

While Seller believes that the information contained herein is accurate, such information is offered solely for its customers' consideration and verification of specific use conditions. This information is not to be deemed a representation of any kind for which Seller assumes legal responsi-

MATERIAL SAFETY DATA SHEET

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I - PRODUCT IDENTIFICATION

COMPANY NAME: Calgon Vestal Laboratories

ADDRESS: 5035 Manchester Avenue
St. Louis, Missouri 63110

Tel No: (314)535-1810
Nights: (314)862-2000
CHEMTREC:(800)424-9390

PRODUCT NAME: Syn-Cide Plus

Product No.: 1123

Synonyms: Industrial Sanitizer

II - HAZARDOUS INGREDIENTS OF MIXTURES

MATERIAL: (CAS#)	% By Wt.	TLV	PEL
n-Alkyl Dimethyl Benzyl Ammonium Chloride (68424-85-1)	3	N/A	N/A
Octyl decyl dimethyl ammonium chloride(32426-11-2	2.25	N/A	N/A
Didecyl dimethyl ammonium chloride(5538-94-3)	1.125	N/A	N/A
Dioctyl dimethyl ammonium chloride(7173-51-5)	1.125	N/A	N/A

III- PHYSICAL DATA

Vapor Pressure, mm Hg: Like Water
Evaporation Rate(ether=1): N/A
Solubility in H2O: Complete
Freezing Point F: N/A
Boiling Point F: Like Water
Specific Gravity H2O=1 @25C: 0.990

Vapor Density (Air=1)60-90F: Like H2O
% Volatile by wt < 5%
pH @ 1% Solution 6.5-8.8
pH as Distributed: N/A
Appearance: Clear slightly hazy liquid
Odor: Slight chemical odor

IV - FIRE AND EXPLOSION

Flash Point F: Not flammable

Flammable Limits: N/A

Extinguishing Media: Product is not flammable or combustible.Use media appropriate for the primary source of fire.

Special Fire Fighting Procedures: Use caution when fighting any fire involving chemicals.Wear self-contained breathing apparatus in the event of a fire.
Unusual Fire and Explosion Hazards: None

V - REACTIVITY DATA

Stability - Conditions to avoid: Unknown

Incompatibility: Strong acids or oxidizers.

Hazardous Decomposition Products: Unknown

Conditions Contributing to Hazardous Polymerization: None known

(Cont'd on Page 2)

VI - HEALTH HAZARD DATA

EFFECTS OF OVEREXPOSURE (Medical Conditions Aggravated/Target Organ Effects,
A. ACUTE (Primary Route of Exposure) EYES:Product may result in irritation or severe damage on contact.SKIN:(Primary Route of Exposure)This product would not be expected to be toxic if.absorbed through skin. Product may result in irritation upon contact.Cases of allergic contact dermatitis have been reported as a result of exposure to some benzalkonium chloride compounds.INHALATION:Inhalation of concentrated mists or vapors may result in irritation of nose,throat and lungs. INGESTION:Product and product solutions may be considered moderately to slightly toxic if ingested.Irritation or swelling of tissues of mouth,throat and stomach may occur.Pain,nausea and vomiting as well as muscular weakness,difficulty in breathing and depressed respiration may result.B.SUBCHRONIC,CHRONIC,OTHER: No data was available to indicate product may result in adverse health effects.

VII - EMERGENCY AND FIRST AID PROCEDURES

EYES:Immediately flush with plenty of water for at least 15 minutes. Seek medical aid.SKIN:Immediately flush with plenty of water for at least 15 minutes.If irritation develops,seek medical aid.INGESTION: Drink promptly large quantity of milk,egg whites,gelatin solution or if not available,large quantities of water.Avoid alcohol.Seek medical aid immediately.NOTE TO PHYSICIAN:Probable mucosal damage may contraindicate the use of gastric lavage.Measurements against circulatory shock,respiratory depression and convulsion may be needed.

VIII - SPILL OR LEAK PROCEDURES

Spill Management: Dike area,contain as much spilled material possible. Absorb on suitable material and place in a sealed container for disposal.Keep out of sewers,drains,surface waters and soil.

Waste Disposal Methods: Do not contaminate water,food or feed by storage or disposal.Do not reuse empty container.Wastes resulting from the use of product may be disposed of on site or at approved waste disposal facility.Dispose of in accordance with all federal,state and local regulations.

IX - PROTECTION INFORMATION/CONTROL MEASURES

Respiratory: Not required	Eye: Chemical splash goggles.	Glove: Rubber

Other Clothing and Equipment: Rubber apron if splashing potential exists.

Ventilation: Local and mechanical exhaust is recommended.

X - SPECIAL PRECAUTIONS

Precautions to be taken in Handling and Storing: DANGER!Keep out of reach of children.Corrosive,causes eye damage and skin irritation.Do not get in eyes,on skin or clothing.May be harmful if swallowed.Avoid breathing spray mist.Avoid contamination of food.Wash thoroughly after handling.
Additional Information: Read and observe all label precautions.

Prepared by:R.C.Jente Revision Date:09/02/87

Seller makes no warranty, expressed or implied, concerning the use of this product other than indicated on the label. Buyer assumes all risk of use and/or handling of this material when such use and/or handling is contrary to label instructions.

While Seller believes that the information contained herein is accurate, such information is offered solely for its customers' consideration and verification under their specific use conditions. This information is not to be deemed a warranty or representation of any kind for which Seller assumes legal responsibility.